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MINISTRY OF HEALTH

# Memorandum on Vaccination Against Smallpox



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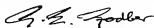


## PREFACE

Recent progress in medicine has affected not only the more important branches of the subject, but also relatively minor procedures among which vaccination against smallpox has its place. Stocks of the previous edition of this Memorandum on Vaccination against Smallpox having been exhausted, the opportunity has been taken to revise the text, incorporating some new material and rearranging it for easier reference on specific points.

Some principal changes are (a) reference to the desirability of pustule formation in aggregate of  $\frac{1}{8}$  inch diameter when primary vaccination is undertaken in the presence of smallpox; (b) a reference to the other precautions to be taken in the vaccination, when in the presence of smallpox, of persons suffering from infantile eczema, hypogammaglobulinaemia or in patients receiving cortico steroid therapy and (c) the reference to vaccinia necrosum.

In the preparation of this Revision valuable assistance and criticism have been given by Sir Graham Wilson, Director, P.H.L.S. and Professor A. W. Downie, Professor of Bacteriology, University of Liverpool. Acknowledgement must also be made to the D.G. A.M.S., War Office, for permission to incorporate certain parts of the War Office Memorandum on Immunological Procedures.



Chief Medical Officer.



## MEMORANDUM ON VACCINATION AGAINST SMALLPOX

1. Vaccination may be done either as a routine immunising procedure, preferably in early childhood, or as an emergency measure in the presence of smallpox.

2. The present freedom of this country from endemic smallpox does not diminish the importance of routine primary vaccination *in the first two years of life*. (See para. 12). Not only does this provide protection at least until the age of school entry but it also makes it likely that subsequent re-vaccination will result in a rapid revival of immunity with a diminished risk of severe local reaction.

3. In this memorandum the practical aspects of vaccination techniques have first been set out and then their application to various vaccination procedures i.e.

- (a) routine primary vaccination in infancy,
- (b) routine primary vaccination at later ages,
- (c) routine re-vaccination,
- (d) vaccination in the presence of smallpox,
- (e) vaccination in relation to other immunising procedures.

Notes are also included on inspection and recordings of results.

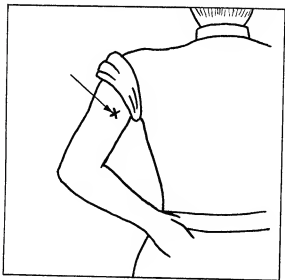


FIG. I

## Vaccination Techniques—Practical Aspects

4. *Site of Insertion.* It is generally agreed that vaccination, especially of infants, is best done on the arm. The site of election is at the junction of the upper and middle thirds of the humerus behind the midline. (See Fig. 1). Here scarring will be less noticeable and the lesion is protected naturally from trauma. Vaccination on the leg tends to lead to severe local and general reactions so that choice of this site entirely for aesthetic reasons is unwise.

5. *Preparation of the skin.* This may include the use of acetone or ether which are said to aid the penetration of vaccinia virus into the skin as well as to have an antiseptic action. If surgical spirit, which is less volatile, is used, time must be allowed for it to evaporate completely before insertion is attempted. Plain soap and water is also satisfactory. Many doctors use nothing at all if the arm is reasonably clean and there is no evidence to condemn this practice. On the other hand non-volatile antiseptics such as iodine or picric acid and cresylic disinfectants such as lysol which will inactivate the vaccine should not be used. It is advisable to avoid vigorous rubbing of the site because this may damage the epidermis and lead to the production of secondary vesicles.

6. *Application of vaccine.* A drop of vaccine lymph covering an area about one eighth of an inch in diameter is placed on the skin at the prepared site. When the usual capillary tubes are used\* the vaccine should be expelled mechanically by using a rubber feeding teat or other suitable device and on no account should it be blown out by the operator. Tubes of lymph should not be heated because the contained vaccine will thereby be inactivated.

### MULTIPLE PRESSURE TECHNIQUE

7. *In the hands of a practised operator* this is the best for routine vaccination and also for emergency use. It has the advantage of being almost painless and, being practically atraumatic, is least likely to be associated with local reactions or secondary infection.

8. For this method a straight needle, flat sided or triangular in section (e.g. a Hagedorn) is required. It should be large, sharp and sterile. It is held parallel or tangential to the arm (between the operator's forefinger and middle finger above and thumb below.) One side of the needle point is pressed firmly and rapidly into the drop of vaccine lymph about thirty times within ten seconds (but see para. 18), the needle being lifted clear of the skin each time. The rapid up and down motion of the needle is in a plane perpendicular to the skin surface (see Fig. II).

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\* The bulk of reserve stocks in the United Kingdom is held in the form of freeze dried vaccine in multidose containers. Instructions for its reconstitution and use will be issued if and when an emergency arises.

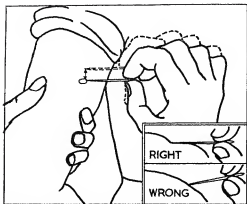


FIG. II. The "multiple pressure" method of vaccination, showing the rapid up and down motion of the side of the needle, held by the hand at the right, against the drop of vaccine on the arm at the left.

9. The needle point is *not* driven into the skin but at each pressure the elasticity of the skin pulls a little of the epidermis over the point of the needle (vide Fig. III), so that the virus bearing lymph is carried into but not below the deeper epidermal layers. If the skin has not been unduly irritated during preparation and the needle has been properly aligned no pain or bleeding should occur.

10. As soon as the pressures have been completed the excess vaccine lymph should be gently wiped away with sterile, (*not antiseptic*), gauze or cottonwool and the remainder allowed to dry. No immediate dressing is essential but some prefer to apply a light sterile, (*not antiseptic*), dressing for the first few days. During the vesicular stage the lesion should, ideally, be kept cool and dry to avoid its maceration and rupture and to promote rapid formation of a firm crust. Dressings attached to the skin usually adhere to the crust on the vesicle and when the dressing is removed this natural protection is torn off. At the stage of maximum reaction a folded piece of sterile gauze can be attached to the inner surface of the garment in contact with the lesion.

11. *Scratch Technique.* If the practitioner prefers to use this technique—and it may be wise for him to do so in an emergency if he is unfamiliar with the multiple pressure method—he should make a superficial scratch of between one eighth and one quarter inch long with a sterile needle through the drop of vaccine lymph which may then be rubbed in gently with the side of the needle. *The drawing of blood should be avoided.*

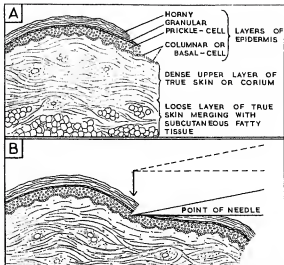


Fig. III (A) Diagrammatic section of the skin of the arm. (B) Same showing the motion of the needle from its first position above and parallel to the skin (indicated by the dotted outline) to its final position pressing against the surface of the skin and entering it slightly.

### Vaccination Procedures

#### ROUTINE PRIMARY VACCINATION IN EARLY CHILDHOOD

12. *Optimum Age.* Routine primary vaccination in the first few weeks of life is not advisable, but it should be carried out sometime before the age of two years. After the age of one year there may be less risk of the rare central nervous system complications, and the presence of eczema, one of the chief contra-indications to vaccination, is unlikely to be missed. Many believe, however, that the best age in a thriving infant is four to five months—particularly because parental acceptance at this age is more certain.

13. *Specific contra-indications.* These are:—

- (a) *exposure to infectious disease;*
- (b) *septic skin conditions;*
- (c) *infantile eczema.* This is an absolute contra-indication to routine primary vaccination. Moreover any infant or person with eczema should be kept away for at least 21 days from any recently vaccinated member of the household. Neglect of this advice may give rise to *eczema vaccinatum* and the risk of death therefrom.
- (d) *hypogammaglobulinaemia.*
- (e) *cortico-steroid treatment.*

14. *Number of insertions.* For routine primary vaccination in early childhood only one area of insertion of not more than one eighth inch diameter is recommended. If the multiple pressure technique is employed thirty pressures are advised.

15. *Locale.* Vaccination at this age can be done at clinics or at doctors' surgeries as safely as at home.

#### ROUTINE PRIMARY VACCINATION AT LATER AGES

16. Although at any age the risk of serious complications following vaccination is much smaller than the risk of death run by those exposed to smallpox while unvaccinated, primary vaccination is not advised as a routine after early childhood. But, if not performed in early childhood, primary vaccination at a later age may eventually become necessary e.g. when serving with the armed forces, as a condition of employment and before undertaking foreign travel.

17. *Contra-indications.* Consideration must be given to

- (a) *septic skin conditions;*
- (b) *a history of or the presence of eczema;*
- (c) *hypogammaglobulinaemia.*
- (d) *cortico-steroid treatment.* It is not considered wise to vaccinate routinely patients who are receiving systemic cortico-steroid treatment.
- (e) *early pregnancy.* On general principles it is desirable to avoid the use of a live vaccine during the first trimester of pregnancy.

18. *Number of Insertions.* A single site of insertion is sufficient; when at these later ages the multiple pressure technique is employed, the number of pressures can be reduced to ten.

#### ROUTINE RE-VACCINATION

19. *Object.* The object of re-vaccination is to maintain or to revive the immunity against smallpox conferred by a previous vaccination or re-vaccination.

20. *Frequency.* The frequency with which routine re-vaccination should be performed varies with circumstances, e.g.:

- (a) *Children primarily vaccinated in infancy*—at 8-12 years of age.
- (b) *Those at Special Risk.* \*Doctors and nurses, and others, who are liable to serve on the staff of smallpox hospitals, and any persons likely to have to deal at short notice with smallpox cases should be re-vaccinated regularly at not more than yearly intervals. At general, children's and infectious disease hospitals, the staff should be offered re-vaccination as a routine at least once in every three years.

21. *Number of Insertions etc.* One small area of insertion and, with the multiple pressure technique, the standard thirty pressures are sufficient.

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\* This need has been emphasised in the following papers issued by the Ministry of Health. RHB/50/22; RHB/50/75; Circ. 6/55; HM(55)34. Annual Reports 1950 p. 21; 1951, p. 25.



## VACCINATION IN THE PRESENCE OF SMALLPOX

22. *Object.* The object in these circumstances is, by primary vaccination or re-vaccination as soon after exposure as possible or, at most, within three days, to enable the individual to gain immunity to smallpox within the normal incubation period of that disease. The more rapid evolution of vaccinal infection relative to that of smallpox makes this possible in most instances. To do this effectively it is probably necessary in a primary vaccination to produce by the eighth day the equivalent, in aggregate, of a pustule at least one half inch in diameter; and it is clearly important to be confident that the technique used will result, as far as possible, in a "take". For these reasons the operator should use the technique with which he is most familiar.

23. *Insertions.* Two areas of insertion are essential and they should be placed at least one inch apart. If the multiple pressure technique is used, thirty pressures at each area are necessary; if the scratch technique is preferred, two scratches each at least one quarter inch long are required.

24. *Contra-indications.* In the presence of suspected smallpox there are no absolute contra-indications to the immediate vaccination or re-vaccination of all close contacts.

### 25. *Anti-Vaccinal Gamma Globulin.*

*In cases of infantile eczema, and hypogammaglobulinaemia and in patients receiving cortico-steroid therapy, anti-vaccinal gammaglobulin should be given into the opposite arm on the same occasion.* This can be obtained from Public Health Laboratories at London, Leeds and Liverpool. Advice as to dosage can be sought from the Directors of these laboratories.

## VACCINATION IN RELATION TO OTHER IMMUNISING PROCEDURES

26. (a) In general, it is preferable that other immunising procedures should not be carried out at the same time as primary vaccination. When such procedures are judged to be essential the injection should be given into the arm other than that used for vaccination.

(b) An interval of at least two weeks should normally be allowed to elapse after an injection of Diphtheria/Tetanus/Pertussis/ or Poliomyelitis vaccine and of at least three weeks after administration of oral poliomyelitis vaccine before undertaking primary vaccination against smallpox. When primary vaccination against smallpox precedes any other immunising procedure it is desirable to allow at least three weeks to elapse.

(c) Tuberculin testing or B.C.G. vaccination should not be carried out until three weeks have elapsed after vaccination against smallpox. Following B.C.G., the vaccinated arm should, if possible, NOT be used for smallpox vaccination (or any other immunising procedure) for six months.

27. *Yellow Fever Vaccination.* Here there are special considerations.

(a) *When yellow fever vaccine and smallpox vaccine are to be given to the same person* it is generally advisable that vaccination against yellow fever should be done first and at least four days before a primary vaccination against smallpox; if primary vaccination against smallpox is done first, there should be an interval of twenty-one days before vaccination against yellow fever.

(b) When, for special reasons, an infant under nine months is to be vaccinated against both yellow fever and smallpox, there should be an interval of twenty-one days between the vaccinations, no matter which is done first.

(c) *Re-vaccination against smallpox* may be done at the same time as yellow fever vaccination but, if time permits, yellow fever vaccination should precede re-vaccination against smallpox by at least four days.

#### INSPECTION OF RESULTS

28. The following table sets out the times of the usual responses of the skin to vaccination. These are subject to considerable variation.

Type of Local Reaction	Papule	Vesicle	Pustule	Scab	Scab off
Primary "TAKE"	4 days	5 days	8 days	11 days	21 days
"Vaccinoid" or "Accelerated"	2 days	3-4 days	4-7 days	5-8 days	8-12 days
"Immediate"	Papule under 1 day. (Usually no vesicle) Fades within 3 days.				

29. *Routine Primary Vaccination.* An inspection on or about the seventh day e.g., at a weekly clinic, is usually sufficient for a correct assessment of the result. In the absence of a local reaction at this time, vaccination should be repeated.

30. *Routine Re-vaccination.* The maximum local reaction may occur at any time within ten days of insertion. An accurate assessment can usually be made by an inspection on the third or fourth day and again on the sixth or seventh day, after which, if there is no evidence of a local reaction, vaccination should be repeated with fresh lymph and the method of lymph storage should be checked\*.

31. *Re-vaccination after Exposure to Smallpox.* Here a second vaccination is essential if no reaction is visible on a third day inspection.

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\* Storage of vaccine lymph. If kept consistently below freezing point (0°C.) vaccine lymph may be expected to maintain its potency unimpaired for at least six months. If the lymph is stored below 10°C, it should maintain its potency for at least fourteen days. If, however, the lymph is kept at ordinary room temperature its potency cannot be assured for more than seven days. Vaccine lymph should be stored in the dark and exposure to any source of heat should be avoided.

Dried smallpox vaccine should retain its potency for at least six months without refrigeration in temperate climates, or for at least one month at tropical temperatures. When opened, this vaccine should be used at once; any surplus should be discarded, unless it can be kept in a refrigerator at a temperature below 10°C when the potency may be maintained for a week.

## Recording of Results

32. *No local Reaction.* The complete absence of local reaction on inspection following primary vaccination or re-vaccination should be regarded in the first place as an indication for at least one further attempt with fresh lymph with a check on lymph storage methods and not necessarily as an indication of immunity to smallpox. A similar result on a second such occasion might be recorded as "*no local reaction to repeated vaccination (or re-vaccination)*" and letter D on the standard local health authority record card could be ringed.

33. *Local Reaction without Vesiculation.* A local reaction reaching maximum size on the second or third day and accompanied by elevation and itching, but without vesiculation, should *not* be recorded as "*Reaction of Immunity*"; it must be remembered that the lymph used may have been so weakened by time, temperature or other causes that it cannot produce the more marked (vaccinoid or vaccinal) forms of reaction which a fully potent lymph might have caused in the same subject; alternatively that an "*immediate*" reaction may indicate no more than skin sensitivity in the individual to protein or other substances in the lymph and not be a response to living vaccinia virus. In some circumstances, therefore, such as probable exposure to smallpox, a further attempt should be made before recording "*maximum local reaction (non-vesicular) on 2nd/3rd day*" or ringing letter C on the standard local health authority record card.

34. *Accelerated Reaction.* When the local reaction reaches maximum size between three and seven days after insertion with some vesicle formation, the result may be recorded as "*accelerated*" or "*vaccinoid reaction*" and letter B on the standard local health authority record card can be ringed. This result usually indicates that the subject has retained only a partial immunity from previous vaccinations.

35. *Typical Primary Vaccinia.* When the local reaction reaches maximum size after the seventh day and there is marked vesicular formation the result should be recorded as "*typical (primary) vaccinia*" and the letter A on the standard local health authority card may be ringed. When re-vaccination causes this reaction it may be assumed that immunity conferred by previous vaccination has become negligible.

36. *Vaccinia Necrosum.* In rare instances, largely unpredictable, a condition known as *chronic progressive vaccinia* or *vaccinia necrosum* develops. This should be considered as a possible diagnosis whenever involution of the lesion at the site of vaccination has not begun by the fifteenth day. In this event consultation should be sought with a view to treatment with anti-vaccinia gamma globulin.

## International Requirements

37. These are dealt with in a Special Notice to Travellers issued jointly by the Ministry of Health and the Department of Health for Scotland.



38. It should be noted that vaccination is not obligatory if a medical contraindication exists. The following is a quotation from the Official Records of the World Health Organisation 54, 56. "If a vaccinator is of the opinion that vaccination is contraindicated on medical grounds, he should provide the person with written reasons underlying that opinion, which the health authority of arrival may take into account. Decision on a claim for exemption from the requirement to be in possession of a certificate lies solely with the health authority of arrival."

39. Persons intending to travel to countries where smallpox is prevalent who show no vaccination scars and who fail to give a local reaction to vaccination or re-vaccination cannot be presumed to have any immunity to smallpox, and, if time permits further attempts should be made to obtain an immunologically significant local reaction (i.e. a vaccinoid (accelerated) reaction or that of typical vaccinia).

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